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Electromagnetics:

Electromagnetic Field Theory

Conditions for Electrostatics

1

Maxwell's Equations at DC

Maxwell's Equations

$$\nabla \times \vec{E} = -\cancel{\frac{\partial \vec{B}}{\partial t}}$$

$$\nabla \times \vec{H} = \vec{J} - \cancel{\frac{\partial \vec{D}}{\partial t}}$$

$$\nabla \bullet \vec{D} = \rho_v$$

$$\nabla \bullet \vec{B} = 0$$

Constitutive Relations

$$\vec{D} = [\varepsilon]\vec{E}$$

$$\vec{B} = [\mu]\vec{H}$$

Electrostatic Equations

$$\nabla \times \vec{E} = 0$$

$$\nabla \bullet \vec{D} = \rho_v$$

$$\vec{D} = [\varepsilon]\vec{E}$$

Magnetostatic Equations

$$\nabla \times \vec{H} = \vec{J}$$

$$\nabla \bullet \vec{B} = 0$$

$$\vec{B} = [\mu]\vec{H}$$

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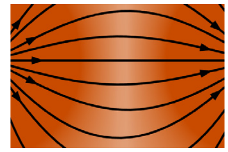
Maxwell's Equations for Electrostatics

Faraday's Law

$\nabla \times \vec{E} = 0$ The curl of $\vec{E}$ is zero.

The electric field intensity $\vec{E}$ is irrotational and forms essentially straight lines.

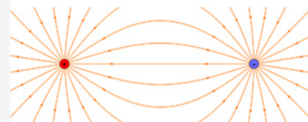


Gauss' Law

The divergence of $\vec{D}$ is equal to charge density ρ_v.

$\nabla \bullet \vec{D} = \rho_v$

Static electric fields can only exist if there are electric charges present.
Static electric fields start and end on charges.



Constitutive Relation

$\vec{D} = [\varepsilon]\vec{E}$ $\vec{D}$ is proportional to $\vec{E}$ scaled by $[\varepsilon]$.

Static electric fields do not see permeability so they are not affected by permeability.

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